Early Adolescent Boys' Exposure to Internet Pornography: Relationships to Pubertal Timing, Sensation Seeking, and Academic Performance

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Abstract

Research has demonstrated that adolescents regularly use Internet pornography. This two-wave panel study aimed to test an integrative model in early adolescent boys (*Mean age* = 14.10; *N* = 325) that *(a)* explains their exposure to Internet pornography by looking at relationships with pubertal timing and sensation seeking, and *(b)* explores the potential consequence of their exposure to Internet pornography for their academic performance. An integrative path model indicated that pubertal timing and sensation seeking predicted the use of Internet pornography. Boys with an advanced pubertal stage and boys high in sensation seeking more frequently used Internet pornography. Moreover, an increased use of Internet pornography decreased boys' academic performance six months later. The discussion focuses on the consequences of this integrative model for future research on Internet pornography.

Keywords: academic performance, Internet pornography, pubertal status, sensation seeking, sexually explicit websites

Early Adolescent Boys' Exposure to Internet Pornography: Relationships to Pubertal Timing, Sensation Seeking, and Academic Performance

A growing number of studies has demonstrated that adolescents are frequently exposed to sexually explicit Internet content (Peter & Valkenburg, 2006; Ševčíková, Šerek, Macháčková, Šmahel, 2013; Vandoninck, d'Haenens, & Donoso Navarrete, 2010). Because this exposure has been linked with various types of sexual risk-taking (Atwood et al., 2012; Braun-Courville & Rojas, 2009; Brown & L'Engle, 2009; Vandenbosch & Eggermont, 2013), scholars have stressed the importance of acquiring a more profound understanding of young people's use of sexually explicit Internet content. There are at least three aspects in this literature to which little attention has been paid. First, research has only to a limited extent addressed how the use of sexually explicit Internet content can be explained by developmental characteristics of the adolescent. Second, what we know about consequences of exposure to sexually explicit online content is restricted to consequences of a sexual nature and tends to be dominated by risky behavior models. To our knowledge, sexually explicit websites have rarely been investigated in the context of other, non-sexual and non-risky, outcomes. Third, predictors and consequences of Internet pornography have rarely been investigated in an integrative model. Nevertheless, such explanatory models may provide important insights in how predictors of Internet pornography are indirectly related to potential adversarial effects of Internet pornography (Valkenburg & Peter, 2013).

To address these limitations, a two-wave panel study was organized among boys aged 12 to 15 years (N = 449). Based on the premises of uses and gratifications theory and development literature (Brown & L'Engle, 2009; Rubin, 1986; Skoog, Stattin, & Kerr, 2009), the first aim of the present study was to investigate whether pubertal timing and level of sensation seeking

predict adolescent boys' exposure to sexually explicit websites. The second aim of the study is to examine whether visiting sexually explicit websites is associated with adolescent boys' academic performance. This objective relates to scholarly knowledge on the time-displacement and cognitive absorption hypothesis, the attention-arousal hypothesis, and literature on pornographic media (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001; Shin, 2004; Valkenburg & van der Voort, 1994). The third aim is to organize theoretical assumptions and research findings on the predictors and academic outcome of boys' exposure to sexually explicit media into one integrative model. This integration is based on theoretical views of the Differential Susceptibility to Media Effects Model (DSMM; Valkenburg & Peter, 2013).

Understanding Adolescent Boys' Exposure to Sexually Explicit Internet Material

Studies have shown that the majority of adolescent boys uses sexually explicit websites. For instance, a study in Dutch adolescents showed that 71% of the boys had accessed sexually explicit online material during the last six months. Although part of the boys explained to use such websites on an irregular basis, the majority of the boys indicated to use these websites at least multiple times per month (Peter & Valkenburg, 2006). A framework that is often used to understand why individuals prefer and select particular media contents, such as sexually explicit websites, is the uses and gratifications theory, which assumes that individuals make media-related choices that match their personal needs and motivations (Katz, Blumler, & Gurevitch, 1974; Rubin, 1986). Regarding the use of sexually explicit websites among adolescents, sexual interest (i.e., sexual curiosity and arousal), which is inherently related to their sexual development (Savin-Williams & Diamond, 2004), may be an important motivation. Research has confirmed that male users access sexually explicit websites for reasons of sexual curiosity and arousal (Goodson, McCormick, & Evans, 2000, 2001).

Developmental psychologists have suggested, however, that sexual interest varies in adolescence and is related to certain characteristics. Two of these characteristics are pubertal status and sensation seeking. With respect to the first, strong indications exist that pubertal maturation is an important factor in the development of sexual interest (Brooks-Gunn & Furstenberg, 1989; Lam, Shi, Stewart, & Fan, 2002). In puberty, adolescents are biologically pushed toward sexual interest (Miller & Benson, 1999). The elevation of hormone levels and the development of secondary sex characteristics tend to change how adolescents experience their body and sexuality, which is likely to elicit a certain sexual interest (Buchanan et al., 1992). For some boys, this elicitation of sexual interest might occur earlier than for others (Miller & Benson, 1999). For instance, Lam, Shi, Ho and Stewart (2002), among others, have confirmed that early maturing boys have more interest in sexuality than boys who are average or late maturers.

With respect to sensation seeking, research has also shown that it influences sexual interest, with high sensation seekers showing more involvement in sexual activities (Savin-Williams & Diamond, 2004). Sensation seeking (Zuckerman, 1994, p.27) can be described as "the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences." Because sexual activities are likely to trigger novel and complex sensations among adolescents, scholars (Arnett, 1996; Henderson et al., 2005) have argued that sensation seeking may increase adolescents' interest in sexuality.

These findings on the sexual interest of high versus low sensation seekers and early versus late developers combined with notions from uses and gratifications theory suggest that pubertal timing and sensation seeking may be predictors of the use of sexually explicit Internet material. This suggestion is confirmed by empirical evidence. Precocious boys access sexually

explicit Internet material more frequently than moderate or late maturing boys (Skoog et al., 2009) and high sensation seekers are more often exposed to sexually explicit Internet material than low sensation seekers (Brown & L'Engle, 2009; Luder et al., 2011; Peter & Valkenburg, 2006; Ševčíková, Šerek, et al., 2013). These relationships will be tested in the current study.

However, there are also indications that both predictors should be examined together in one integrated model. Relying on notions about a relationship between pubertal status and sensation seeking (Steinberg, 2005), Wolfe, Jaffe and Crooks (2006) have argued that pubertal changes may trigger novel sensations among adolescents and, consequently, may increase their levels of sensation seeking. This reasoning has been supported by Martin et al. (2002) who reported a positive relationship between pubertal development and sensation seeking, irrespective of the influence of age. Moreover, this study (Martin et al., 2002) has also demonstrated that sensation seeking may mediate relationships between pubertal status and sensational, risky activities as the authors reported that pubertal status predicted sensation seeking, which in turn predicted drug use. Applying such insights on sensation seeking as an explanatory mechanism to boys' use of sexually explicit Internet material suggests that sensation seeking (partly) mediates the relationship between pubertal status and exposure to sexually explicit websites: Boys in an advanced pubertal stage are more prone to seek out high sensational experiences. Such novelty seeking may, in turn, lead them towards the use of exciting sexually explicit Internet content.

Following this theoretical and empirical evidence pointing to relationships between pubertal status, sensation seeking and the use of sexually explicit Internet material, the first objective of this study was to test these relationships in an integrative model, with particular attention to the mediating role of sensation seeking.

Sexually Explicit Internet Material and Academic Performance

For the second objective of the study, this model is extended with the concept of academic performance. Various scholars have highlighted the importance of academic performance for adolescents' development and well-being. In research on teenagers' involvement in risk-taking, academic achievement has been identified as a protective factor at the personal level, suggesting that high academic achievers are less likely to engage in risk behavior (Jessor & Jessor, 1977; Jessor, Costa, Jessor, & Donovan, 1983). Low academic achievement is associated with an earlier onset of sexual intercourse (Jessor et al., 1983), poorer social skills (Malecki & Elliot, 2002), and engagement in aggressive and/or delinquent behavior (Barriga et al., 2002).

In media literature, concerns have been expressed about the academic performance of young people who spend a lot of time with certain media. Media use, especially in large amounts, has been suggested to decrease the time that needs to be spent with school work or the time that could be spent with cognitively stimulating activities; media use is thus expected to elicit a time displacement that leads to lower academic achievement (Young, 1998; Shin, 2004). These expectations have been warranted in studies that have linked the frequency of, for instance, television viewing or internet use with poor academic performance (Hancox, Milne, & Poulton, 2005; Sharif, Wills, & Sargent, 2010; Tremblay et al.,2011; Chen & Peng, 2008).

Similar evidence has shown that the more college students consume sexually explicit media material, the lower they score academically (Wittwer & Senkbeil, 2008). Analogous to the effects of, for instance, television viewing, this relationship can be interpreted as a time displacement effect. The time devoted to pornography consumption takes time away that could have been spent with cognitively important activities. Yet, Anderson et al. (2001) have indicated

that not just the time adolescents spend using pornography may be relevant to explain such relationships, but also the content, in two ways. First, a negative effect from pornography consumption on academic performance may be related to the cognitive absorption hypothesis (Agarwal & Karahanna, 2000). Cognitive absorption refers to the state of complete involvement in an activity that is highly pleasurable, excites cognitive and sensory curiosity and arouses imagination; this absorption is believed to make other attentional demands inferior such that one loses track of time (Agarwal & Karahanna, 2000). Research has shown that high levels of cognitive absorption in online videogames (Barnes & Pressey, 2013) and social networking sites (Rouis, 2012) results in "deep attention" and complete engagement in the activity (Agarwal & Karahanna, 2000). This absorption in online activities can be so immersive that other demands that require attention are ignored and that the performance of school tasks is disregarded (Rouis, Limayem, & Salehi-Sangari, 2011). Similarly, adolescents who use pornographic websites may experience high levels of cognitive absorption, that is, a complete involvement because of the pleasurable and exciting nature of the pornographic content, which may lead to insufficient consideration of homework or studying, and, consequently, result in poor academic performance.

Second, a negative relationship between the use of sexually explicit content and academic performance may be due to the sexual arousal that is triggered by exposure to X-rated material (Cantor, Zillman, & Einsiedel, 1978; Cowan & Dunn, 1994; Davis et al., 2006; Mayerson & Taylor, 1987; Peter & Valkenburg, 2008a). Zillmann's excitation transfer model (1971; Zillmann, Hoyt & Day, 1974) as well as Byrne's (1977) sexual behavior sequence suggest that such arousal is expected to stimulate impulsive and "restless" behaviors, such as sexual conduct, but not attention-demanding behaviors, such as studying or doing homework (Singer & Singer, 1986; Valkenburg & van der Voort, 1994). Literature on brain development (Owens et

al., 2012; Redoute et al., 2000) confirms that sexual stimuli trigger sexual arousal and subsequently also short-term needs of (sexual) gratification, thus discouraging engagement in activities with long-term goals, such as studying. These theories thus suggest that the arousal that comes from using pornographic Internet content may impede academically oriented activities and may, consequently, impair academic performance (Singer & Singer, 1986). It is the second objective of this study to describe this relationship longitudinally.

Integrated Model

The hypotheses of this study are consistent with premises of the recently proposed Differential Susceptibility to Media Effects Model (DSMM; Valkenburg & Peter, 2013). The DSMM proposes that individual-difference variables predict media use, which, in the context of the present study, means that puberty and sensation seeking predict the use of sexually explicit Internet material. In addition, the DSMM explains that media use, in turn, predicts a particular outcome, which in our study refers to academic underachievement. Moreover, the DSMM proposes that media use tends to mediate relationships between individual-difference variables and the outcome of interest. Therefore, the third objective of the current study is to integrate these assumptions into a comprehensive model that tests whether the use of sexually explicit Internet material mediates potential relationships between pubertal status and academic achievement, and between sensation seeking and academic achievement.

Figure 1 presents the hypotheses of the study. When testing these hypotheses, the study will focus on boys and take account of some important control variables. The focus on adolescent boys relates to their more frequent use of sexual content (Peter & Valkenburg, 2006; Ševčíková, Šerek, et al., 2013), their higher levels of sensation seeking (Beyens & Eggermont, 2014; Peter & Valkenburg, 2008b; Zuckerman, 1994) and lower academic performance on

average (Chambers & Schreiber, 2004; Soenens & Vansteenkiste, 2005). Given relationships between adolescents' school performance and their parents' educational level (Abd-El-Fattah, 2006; Schiller, Khmelkov, & Wang, 2002) and their total internet use (Chen & Peng, 2008), these variables will be included as control variables.

[Figure 1]

Method

Participants and Procedure

A two-wave panel study was conducted among Belgian adolescents. Approval for the study was obtained from the Institutional Review Board of the KU Leuven and all ethical requirements were followed according to the appropriate procedures that apply in Belgium. Data were collected using a two-step sampling method. First, schools representing different educational levels located in different regions of Flanders (the Dutch-speaking part of Belgium) were randomly selected and asked to participate. Second, within the nine schools that agreed to participate, students representing different educational levels and different ages were asked to participate. Boys and girls were eligible to participate if they were between 12 and 18 years old. As is customary in Belgium, informed consent was received from the school principals, who are considered as the legal guardians of the students. In the second step, research assistants visited the schools and invited all students who were present at the day the survey was administered to complete the paper-and-pencil questionnaire. Students were told that the goal of the study was to investigate their leisure habits. To enhance confidentiality, the researchers ensured that students were unable to discuss or look at each other's answers. Additionally, confidentiality and anonymity were assured by asking students to write their identification data on separate forms and by guaranteeing that survey answers would be processed separately.

Six months later, a second survey was conducted in the 9 schools that had participated in the first wave of data collection. Respondents were tracked over time by linking the identification forms from waves 1 and 2.

Overall 1,504 12- to 18-year-old adolescents completed the questionnaire at baseline and a total of 1,426 12- to 18-year-olds completed the questionnaire at the second wave. For the purposes of the present study, only the data collected from boys aged 12 to 15 years (*Mean age* = 14.10, *SD* = .80) were analyzed. At baseline, 449 boys completed the questionnaire. At the second wave, 441 boys completed the survey. A total of 325 boys completed the questionnaires for both waves. This was our analytical sample. To test our hypotheses, cases having partially missing data were included in the analyses applying maximum likelihood. The relationships were estimated based on all the information available.

Most of the boys were born in Belgium (93.5%), 1.4% in another European country and 5.1% in a non-European country. The majority of the boys' parents lived together, either married (63.8%) or not (5.1%), and 28.6% of the parents were divorced. A small portion of the boys indicated that one of their parents was deceased (2.5%). Most fathers had a college or university degree (47%) and 43.7% had obtained a high school degree; 3.6% had obtained an elementary school degree and 5.7% did not have a degree. The majority of the students' mothers had a college or university degree (58.6%), almost four in ten had a high school degree (35.5%), 2.9% obtained an elementary school degree and another 2.9% did not have a degree.

Measures

Pubertal Timing. In accordance with prior research (McCabe, Ricciardelli, & Finemore, 2002), boys' pubertal status was measured using two items ($r = .52$, $p < .001$) of the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988): "Describe the level of body

hair growth" and "Describe the development of voice change." Adolescents could answer these items with *not yet started* (1), *just started* (2), *is still going on* (3), or *seems complete* (4). From the score of each boy we subtracted the average score of boys of the same age. The new variable, pubertal timing, thus represented a boy's pubertal status relative to that of the same-aged boys in the sample. Boys scoring higher on this variable are more advanced in pubertal maturation, boys scoring low are less advanced in maturing, and boys scoring the average score are maturing on-time. This representation is similar to that used in prior research on the role of adolescent boys' pubertal timing in boys' Internet use (Skoog et al., 2009).

Sensation Seeking. The Brief Sensation Seeking Scale-4 (BSSS-4) was used to measure Sensation Seeking (Stephenson et al., 2003). Using a five-point scale ranging from *never true* (1) to *always true* (5), adolescents indicated their agreement with four items, such as "I like new and exciting experiences, even if I have to break the rules" (α = .73; M = 3.38, SD = .92). By summing the item scores and dividing the sum by the total of items, an estimate of Sensation Seeking was produced. Higher scores on this variable indicate higher levels of Sensation Seeking.

Sexually Explicit Websites. Boys rated, on a 7-point scale (*never* = 1 through *several times a day* = 7), how often during the past 6 months they had intentionally exposed themselves to (a) pictures with clearly exposed genitals, (b) videos with clearly exposed genitals, (c) pictures in which people are having sex, and (d) videos in which people are having sex (Peter & Valkenburg, 2008a, b) (α = .91; M = 2.01, SD = 1.25). Following the procedure used by Peter and Valkenburg (2008a, b), these four questions were introduced by referring to the use of online pornographic websites. By summing the four item scores and dividing the sum by the total of

items, an average score for the use of sexually explicit websites was produced. Higher scores on this variable indicate higher levels of use of sexually explicit websites.

Academic Performance. Boys reported their average school grade (0-100).

Control Variables. Respondents were asked to indicate their father's and mother's educational level (*no degree, elementary school*, *secondary school, college*, *university*) and to rate how often they use the Internet by indicating for each day of the week on a timeline the periods of time during which they usually use the Internet. The frequency of Internet use in hours per day was calculated by adding up all of the marked time periods. Higher scores on this variable indicate higher levels of use of the Internet.

Analyses

Path analysis (Bollen, 1989) was used to test the relationships in our model. Analyses were performed using AMOS (Arbuckle, 2009). First, to investigate the hypothesized relationships, we tested the fully mediated model as shown in Figure 1. According to the procedure outlined by Aish and Jöreskog (1990), modification indices were examined to consider potential misspecifications, and models were revised and re-specified if necessary by adding parameters and removing nonsignificant parameters from the models. The goodness of fit of the models was determined using the ratio of chi-square to degrees of freedom (χ^2/df), the Comparative Fit Index (CFI), the Root-Mean-Square Error of Approximation (RMSEA), the Goodness of Fit Index (GFI), and the Adjusted Goodness of Fit Index (AGFI) (Browne & Cudeck, 1992; Byrne, 2001).

Indirect effects were computed by calculating the product of the relevant indirect standardized path coefficients, as outlined by Cohen and Cohen (1983). To examine the

significance levels of the indirect effects, Sobel's approximate significance test (Sobel, 1982) was used (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Preacher & Hayes, 2004).

The educational level of the boys' fathers and mothers, boys' frequency of Internet use, as well as their academic performance at the first wave were included as control variables.

Results

Descriptive Statistics

Boys' school grades ranged from 40 to 93 out of 100 (M = 73.98, SD = 8.51) at baseline, and from 43 to 92 out of 100 (M = 73.61, SD = 7.66) at the second wave, which corresponds to US grades and grade point averages (GPA) from F (GPA = 0) to A+ (GPA = 4) and a mean grade of B (Mean GPA = 3). The mean school grade is similar to those reported in previous studies among early adolescents (Mounts, 2001; Véronneau & Dishion, 2011). At baseline, boys showed moderate levels of sensation seeking (M = 3.38, SD = .92). Approximately one in eight boys (13.1%) appeared to be maturing on time at baseline, nearly four in ten (38.8%) appeared to be in a less advanced pubertal stage compared to same-aged boys, and 48.1% appeared to be in a more advanced pubertal stage than their same-aged peers. More than four in ten boys (42.6%) indicated at baseline that they had visited sexually explicit websites, although most of them on a rather irregular basis. More specifically, one in five boys (21.6%) had visited sexually explicit websites less than once per month, one in ten (10.7%) had visited them monthly, and another ten percent (10.3%) had visited them weekly to daily.

In order to examine possible differences between boys who participated in both waves and drop-outs, t-tests were performed on the key variables. No difference was found for sensation seeking, $t(437) = .76$, p = .45. The results for pubertal status, $t(385) = 1.68$, p = .09, use of sexually explicit websites, $t(176.01) = 1.99$, p = .05, and school performance, $t(91.290) =$

-1.82, p = .07, were marginally significant, indicating that drop-outs scored higher on pubertal status and use of sexually explicit websites, and lower on academic performance than the boys participating in both waves.

All variables in the model were normally distributed, with absolute Skewness values ranging from .10 to 1.42 and absolute Kurtosis values ranging from .06 to 1.57 (Curran, West, & Finch, 1996): Pubertal Timing at Wave 1 (Skewness = -.10, SE = .12 and Kurtosis = -.39, SE = .25), Sensation Seeking at Wave 1 (Skewness = -.44, SE = .12 and Kurtosis = -.12, SE = .23), Use of Sexually Explicit Websites at Wave 1 (Skewness = 1.42, SE = .12 and Kurtosis = 1.57, SE = .23), and Academic Performance at Wave 2 (Skewness = -.34, SE = .15 and Kurtosis = .73, SE = .29). Hence, no special estimators were needed to address nonnormality (Kline, 2011).

Zero-order correlations between Wave 1 and Wave 2 measures of pubertal timing, sensation seeking, visiting sexually explicit websites and school performance, and control variables are presented in Table 1.

[Table 1]

Testing the Hypothesized Model

The model presented in Figure 1 was tested to investigate the hypothesized relationships. The final model (Figure 2) showed an adequate fit of the data, χ^2 (17) = 37.627, χ^2/df = 2.213, p < .01, CFI = .956, RMSEA = .056, GFI = .976, AGFI = .949.

[Figure 2]

Consistent with our expectations, this model showed that pubertal timing predicted boys' use of sexually explicit websites, β = .15, B = 0.27, SE = 0.08, p < .01. Boys in a more advanced stage of pubertal development visited sexually explicit websites more frequently. The analyses also indicated that boys in a more advanced stage of pubertal status had higher levels of

sensation seeking, β = .15, *B* = 0.19, *SE* = 0.06, $p < .01$. Consequently, boys' level of sensation seeking significantly predicted their use of sexually explicit websites, with high sensation seekers visiting those websites more frequently, β = .12, *B* = 0.16, *SE* = 0.07, $p < .05$. Mediation tests revealed that boys' level of sensation seeking marginally significantly mediates the relationship between boys' pubertal status and use of sexually explicit websites (.02 = .15 x .12; $z = 1.71$, $p = .09$).

The findings further revealed that boys' use of sexually explicit websites significantly predicted their school performance, β = -.09, *B* = -0.56, *SE* = 0.22, $p < .05$, over and above the impact of their academic performance at Wave 1 and the control variables. The more boys used sexually explicit internet content, the poorer their school grades were six months later.

Mediation tests showed that the use of sexually explicit websites mediates the relationship between boy's pubertal status and academic performance (-.01 = .15 x -.09; $z = -1.95$, $p < .05$). Thus, early maturing boys use more sexually explicit websites and, consequently, perform poorer academically. The relationship between sensation seeking and academic performance was marginally significantly mediated by use of sexually explicit websites (-.01 = .12 x -.09; $z = -1.70$, $p = .09$).

Discussion

The present study extends our understanding of the predictors and consequences of early adolescent boys' exposure to Internet pornography. More specifically, this study found relationships between adolescent boys' exposure to Internet pornography and pubertal timing, sensation seeking, and academic performance. Several conclusions can be drawn.

First, this study provides important lessons on the characteristics that predict boys' use of pornographic media. Both pubertal status and sensation seeking predicted boys' use of sexually

explicit websites. Literature suggests that this may be explained by differential levels of sexual interest (Henderson et al., 2005; Lam et al., 2002) which according to uses and gratifications theory draws adolescent boys towards sexually arousing materials (Katz, Blumler, & Gurevitch, 1974; Rubin, 1986). Moreover, our study indicated that pubertal timing and sensation seeking should be examined together, because pubertal status also predicted sensation seeking, which, subsequently, increased the use of sexually explicit websites. Thus, boys in a more advanced stage of pubertal development and boys with high levels of sensation seeking, which is more prevalent among boys with a more advanced pubertal status, more often visit sexually explicit websites.

This study suggests that it may be warranted to consider how predictors of the use of pornography are related, because it may further inform us on why adolescents use sexually explicit material. For instance, while this research focused on how biological and personality predictors at an individual level are related, social predictors may also be relevant in such processes. Future research may explore the role of perceived peer pressure in relationships between pubertal status, sensation seeking and sexual content. Prior research has shown that early developing boys are more likely to affiliate with deviant peers (Ge, Brody, Conger, Simons, & Murry, 2002) and that high sensation seekers affiliate with individuals with similar sensational and exciting interests (e.g., Romer & Hennessy, 2007; Yanovitzky, 2006). Studies within the context of peer cluster theory (Oetting & Beauvais, 1987), have shown that characteristics such as sensation seeking predict the choice of peers, which in turn predicts substance use (Yanovitzky, 2005, 2006). Accordingly, adolescents' relationships with members of their peer cluster may mediate the relationships of pubertal status and sensation seeking with the use of sexually explicit Internet content. It is likely that within such peer communities, consumption of

sexually explicit material is more accepted and thus encouraged, causing adolescents to perceive normative pressure to consume pornographic media. In this view, a study of Bleakley et al. (2011) already reported that exposure to sexual media is predicted by perceived normative pressure to consume sexual media. Future research is needed to test this explanation.

In addition, while the current study focused on sexually explicit websites, future research examining related predictors may also address other online sexual activities, such as sexually oriented computer-mediated communication. This seems plausible, as previous studies have revealed that high sensation seekers more frequently engage in online sexual risk behaviors, such as sending sexually explicit pictures or communicating in a sexually arousing way (Baumgartner, Sumter, Peter, & Valkenburg, 2012; Beyens & Eggermont, 2014). Moreover, such future research on boys' use of Internet pornography and other online sexual activities may consider that such online activities are inherent to normal adolescent development, as others have noted (Koyama, Corliss, & Santelli, 2009; Ševčíková, Vazsonyi, Širůček, & Konečný, 2013). Such sexually explorative behavior may not always be problematic, though attention is required as the current study in line with other studies on Internet use (e.g., Baumgartner et al., 2012; Peter & Valkenburg, 2008b) warrants again attention for the consequences of online sexual activities.

Second, the current study further informs us on the consequences of exposure to Internet pornography for early adolescent boys' academic performance. More specifically, our findings indicate that using sexually explicit websites decreases boys' school performance six months later, even after controlling for boys' academic performance at the first wave . These findings provide new insights into the consequences of adolescent boys' sexually explicit media use. While previous research has mainly focused on consequences with regard to sexual behavior and sexual risk-taking, our study is one of the first to indicate that the impact of Internet pornography

encompasses a wider scope and is not restricted to consequences of a sexual nature. A next step in this research may be to investigate whether these relationships may be satisfactorily explained by time displacement, cognitive absorption or attention-arousal effects. Regarding time displacement, the present study suggests that time spent in sexual activities displaces time that needs to be spent at other, non-media and not sexually related activities, such as school work or studying. For cognitive absorption, the findings suggest that being highly involved and completely immersed in a sexual activity, impedes attention and engagement in non-sexual activities, such as academically oriented activities. Furthermore, while arousal is a stimulator of risky sexual activities, our study suggests that the impact of sexual arousal may extend to other domains, such as academic performance. Future research is needed to clarify which explanation is most accurate or whether these explanations are complementary. While this study integrates theoretical perspectives about the notion that the consumption of pornographic Internet content interferes with academic activities, future studies may further entangle the relationships found in our study, by including measures of the theoretical concepts, and may investigate whether these theories could equally be applied to other attractive and potentially time-consuming activities. Also, future research may investigate whether the impact of pornography use also extends to other non-risky consequences. For instance, future studies should also examine the role of Internet pornography in adolescents' learning about sexuality and sexual pleasure.

Third, in line with premises of the DSMM (Valkenburg & Peter, 2013), we found support for an integrated model of pubertal status, sensation seeking, sexually explicit Internet material and academic performance. The organization of developmental predictors and consequences of boys' exposure to sexually explicit media in an integrated model revealed valuable mechanisms that link boys' pubertal status and sensation seeking with their academic performance. By

identifying Internet pornography as a mediator in this model, we have uncovered an underlying process through which puberty and sensation seeking affect academic performance. While until now most studies have focused on either the developmental predictors of sexually explicit media use (e.g., Skoog et al., 2009) or the consequences of sexually explicit media use (Braun-Courville, & Rojas, 2009), this study highlights the importance of testing the full model, including developmental predictors as well as outcomes of sexual media use. Adolescents' predictors and outcomes of sexual media use cannot be dissociated from each other but should be examined together in one integrated model.

Although this study has several strengths, some limitations should be noted. First, our study was strengthened by its longitudinal design but limited by the fact that drop-outs scored (marginally significantly) higher on pubertal status and use of sexually explicit websites, but lower on academic performance. Therefore, this study may be underestimating the relationships among pubertal status, use of sexually explicit websites and academic performance. Future research may be necessary to explore this influence in greater detail.

Second, adolescents' self-report of academic performance may be biased, because studies have shown that students usually overestimate their grades (Kuncel, Credé, & Thomas, 2005). However, other studies have demonstrated that self-reported school performance correlates with teacher report measures (Anderson et al., 2001) and students' actual grade point average (GPA; Dornbusch, Ritter, Leiderman, Roberts, and Fraleigh, 1987).

Third, sensation seeking marginally significantly mediated the relationship between pubertal status and Internet pornography, and Internet pornography marginally significantly mediated the relationship between sensation seeking and academic performance. Future studies in larger samples would provide a more solid investigation of our model and may find stronger

relationships. Also, although we adjusted for several control variables, it is possible that the relationships found in this study are confounded by other personality or developmental aspects that were unmeasured. For instance, a failure to exercise self-discipline might play a role, as adolescent boys who are less self-disciplined typically have lower academic performance (Duckworth & Seligman, 2005, 2006). In addition, self-discipline may also relate to consuming pornography, and thus suggest that the relationship between consuming pornography and academic performance is a spurious relationship. Another possible confounding variable may be boys' engagement in sexual activities other than Internet pornography use, which may predict both school performance deterioration and pornography use. Further, boys' sexually explicit Internet use might be associated with boys' total media exposure, not just porn exposure. For instance, boys' porn exposure might be an indicator of adolescents' total media use, which may elicit a time displacement that leads to lower academic achievement (Young, 1998; Shin, 2004). Yet, our study showed that boys' total Internet use predicted their sexually explicit Internet use only to a rather small extent, suggesting that it is the sexually explicit use that matters.

Finally, as the role of Internet pornography may differ according to cultural narratives and because the data in this study were collected in a rather liberal country (Hofstede, 2001; Van den Bulck, 2012), that is Belgium, more research is needed in other, for instance less sexually liberal, contexts.

Conclusion

The findings of the current study offer valuable insights to our understanding of early adolescent boys' exposure to Internet pornography and consequent academic performance. The present study unraveled important relationships between early adolescent boys' pubertal status, sensation seeking, use of sexually explicit Internet material and academic performance.

Knowing why these relationships occur is an important next step for designing effective interventions that reduce the risks for poor school achievement.

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Tables

Table 1

Zero-Order Correlations

	Pubertal Timing W1	Pubertal Timing W2	Sensation Seeking W1	Sensation Seeking W2	Sexually Explicit Websites W1	Sexually Explicit Websites W2	Academic Performance W1	Academic Performance W2	Total Internet Use W1	Educational Level Father W1	Educational Level Mother W1
Pubertal Timing W1	1	.601***	.149**	.194**	.216***	.095	-.084	-.069	.200***	.040	-.024
Pubertal Timing W2		1	.154**	.184**	.133*	.171**	-.029	-.021	.149*	.024	-.01
Sensation Seeking W1			1	.567***	.165**	.133*	-.024	-.023	.110*	.128*	.003
Sensation Seeking W2				1	.214***	.197**	-.034	.008	.086	.204**	.065
Sexually Explicit Websites W1					1	.534***	-.083	-.143*	.276***	.014	.038
Sexually Explicit Websites W2						1	-.029	-.094	.159**	.105	-.012

Academic Performance W1	1	.689***	-.215***	.166*	.188**
Academic Performance W2		1	-.144*	.111	.196**
Total Internet Use W1			1	.040	-.082
Educational Level Father W1				1	.491***
Educational Level Mother W1					1

Note. *p < .05. **p < .01. ***p < .001

Figures

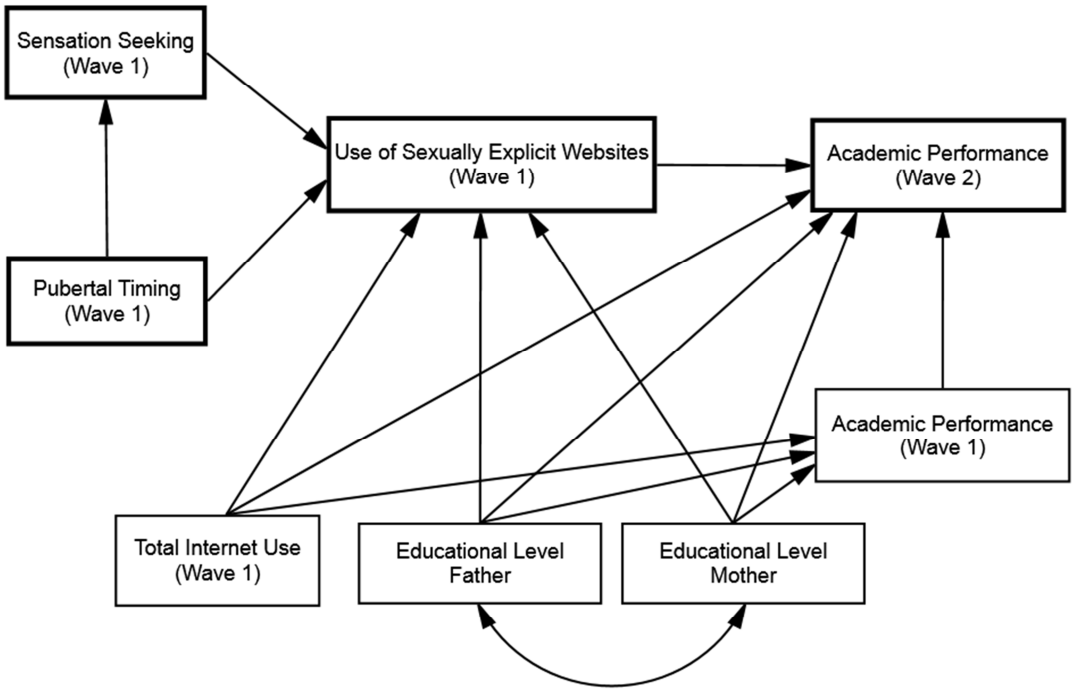

Figure 1. Hypothesized model for the relationships between pubertal timing, sensation seeking, use of sexually explicit websites and academic performance.

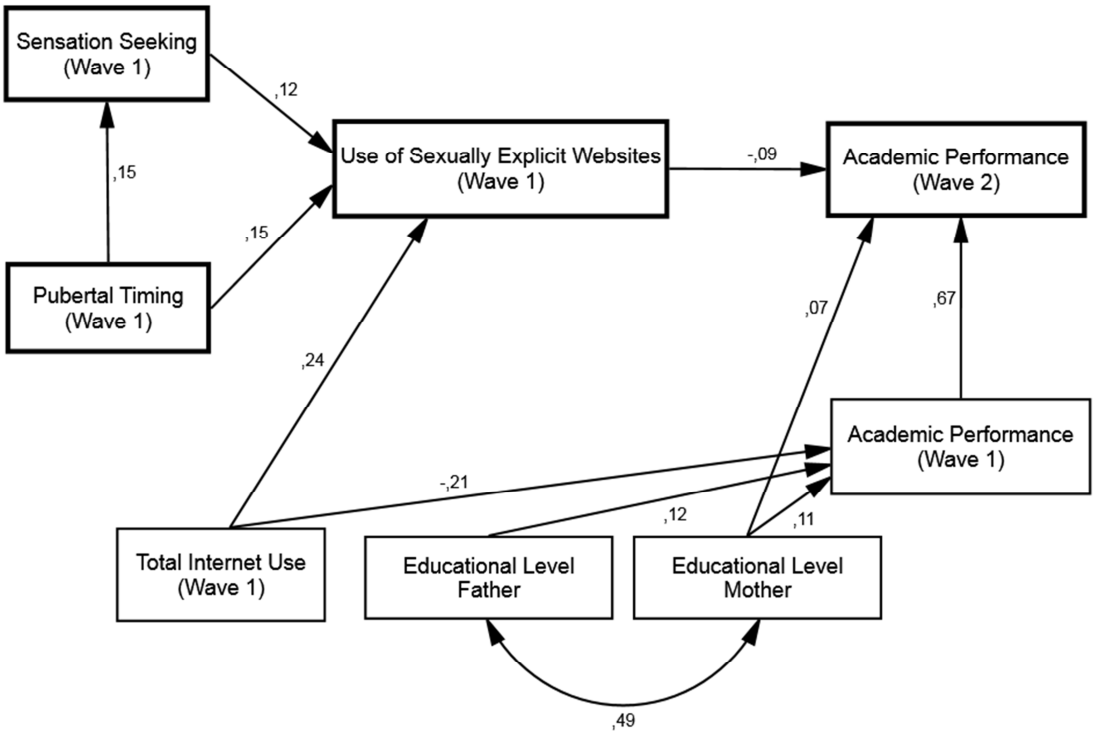

Figure 2. Path model for the relationships between pubertal timing, sensation seeking, use of sexually explicit websites and academic performance. Path coefficients are presented in standardized form. All paths are significant at $p < .05$. For clarity of presentation, error terms are not shown.

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